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filling said groove with a metal film;
 forming a metal film evaporated on the entire resulting surface; and
 patterning said metal film to form a source electrode which is electrically connected to said metal filled in said groove.

2. A method for manufacturing a vertical power field effect transistor comprising the steps of:

forming a drain layer of a first conductivity type at an upper surface of a semiconductor substrate of said first conductivity type;

forming at an upper surface of said drain layer a base layer of a second conductivity type opposite to said first conductivity type;

forming a source layer of said first conductivity type at an upper surface of said base layer;

forming in said substrate a plurality of vertical trenches separated from each other and passing through said source layer and said base layer to reach said drain layer; forming a gate oxide film covering said principal surface of said substrate and an inner surface of said trenches;

forming a gate electrode layer covering said gate oxide film at said principal surface of said substrate and within said trenches;

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forming a first interlayer insulating film on said gate electrode layer at said principal surface of said substrate and within said trenches;

patterning a stacked structure composed of said gate oxide film, said gate electrode layer and said first interlayer insulating film so as to form a pattern stacked structure and to expose a portion of said substrate, said gate electrode layer of said patterned stacked structure forming a gate electrode;

forming a second interlayer insulating film on said principal surface of said substrate;

anisotropically etching said second interlayer insulating film so as to form a side insulating film which covers only each side surface of the gate electrode, the gate insulator film and the remaining first interlayer insulating film;

anisotropically etching said substrate by using the side insulating films as a mask, so as to form, in a self-alignment manner, a groove which extends downward from said principal surface of said substrate to pass through said source region and to reach said base region;

filling said groove with a metal film;

forming a metal film evaporated on the entire resulting surface; and

patterning said metal film to form a source electrode which is electrically connected to said metal filled in said groove.

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